Nobushige KATO*: **On the variation of nodal types in the woody plants (2)**

(A Contribution to the nodal anatomy 2)

加藤僖重*: 節型の変異 (2)

In addition to my first report on the subject[1], new examples of nodal types were obtained. They will be described below.

Material and Methods The material used were branchlets of the year of *Ficus erecta* Thunb., *F. nipponica* Fr. et Sav., *Hydrangea involucrata* Sieb., *Rubus sieboldi* Bl. and *Weigela decora* Nakai. The same methods were employed as described in my previous report.

Observations *Ficus erecta* Thunb. Twenty branches from five individuals were examined. Tri-, tetra- and pentalacunar types are found in each branch from the basal to the uppermost node in sequence as follows: 3-4-4-4-4-5-5-5-3-5-5-

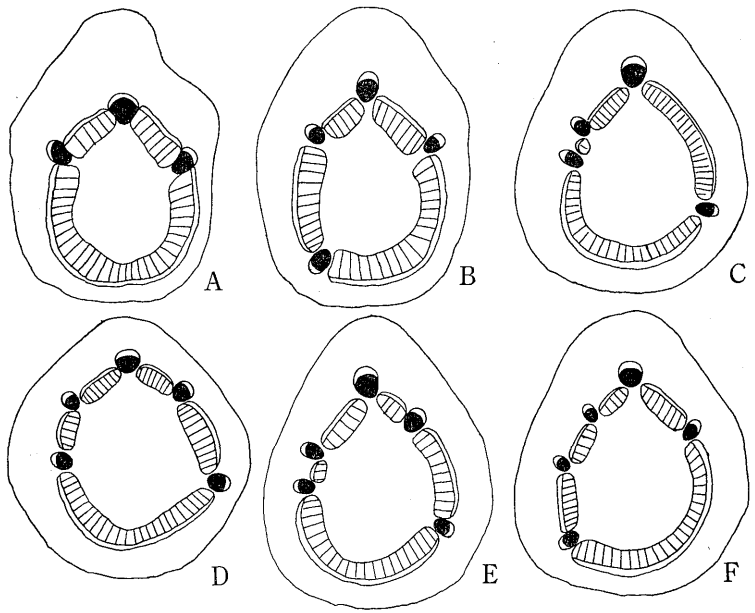

Fig. 5. *Ficus erecta* Thunb.
A. Trilacunar type. B, C. Tetralacunar type. D, E, F. Pentalacunar type.

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5-5; 3-4-4-3-5-3-4-4-4-4-5-4-5-5-5; 5-5-5-4-4-5-5-4-5-4-5-5-5-5, etc. A few trilacunar types are observed (fig. 5: A). In this species, each trace consists always of one strand only. But there are various forms in the tetra- and pentalacunar

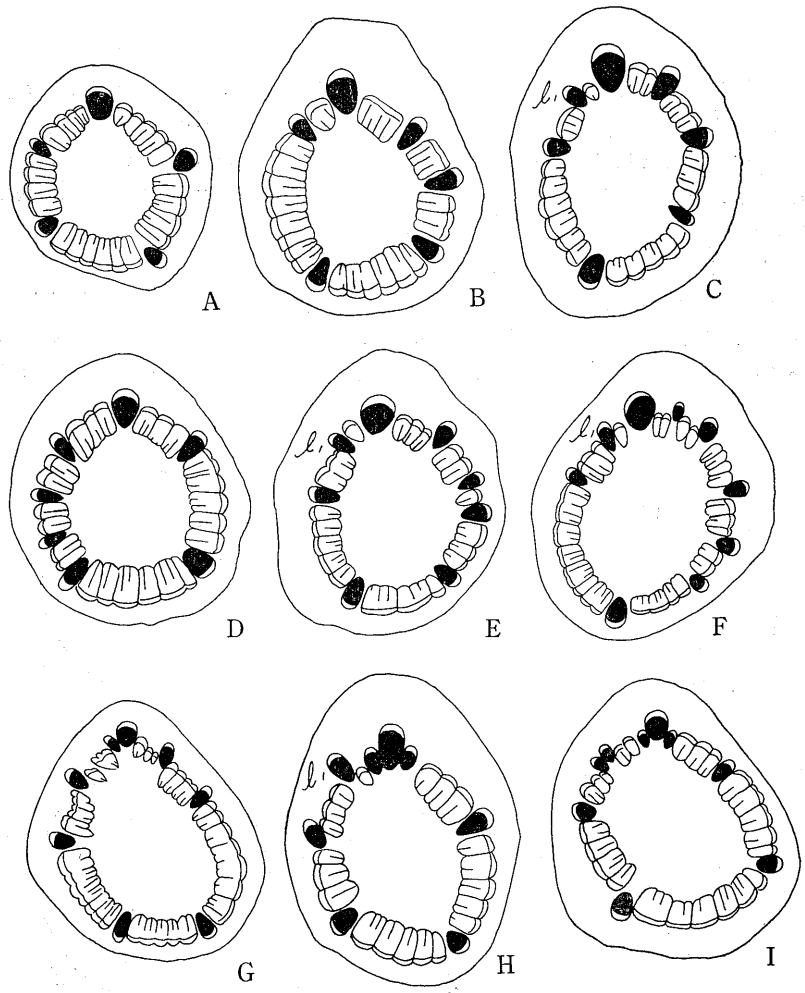

Fig. 6. *Fiscus nipponica* Fr. et Sav.

A. Pentalacunar type. B. Hexalacunar type. C. Heptalacunar type. D. Heptalacunar type (asymmetrical form). E. Octolacunar type. F. Nonalacunar type. G. Heptalacunar type (main trace consists of two strands). H. Hexalacunar type (main trace consists of three strands). I. Hexalacunar type (main trace consists of three and one of the lateral traces consists of two strands). ℓ_1. lateral trace.

types whose positions of gaps are different. Fig. 5 : B shows the common tetralacunar type. It looks as if one of the lateral traces of pentalacunar type as in fig. 5 : D is suppressed. In a form of tetralacunar type as in fig. 5 : C, two lateral traces are very close each other. The same condition is observed in a form of pentalacunar type (fig. 5 : E). In a form of pentalacunar type as in fig. 5 : F, the gaps are arranged asymmetrically compared with the forms as in fig. 5 : D.

Ficus nipponica Fr. et Sav. Twenty-five branches from ten individuals were examined. 5-, 6-, 7-, 8-, and 9-lacunar types are found in an irregular sequence in each branch as follows : 7-6-6-8-6-8-9-9-8 ; 5-5-5-6-6-7-6-7-6-7 ; 8-8-7-7-8-7-7, etc. In most cases each trace usually consists of one strand (fig. 6 : A~F), but more rarely there are forms whose main trace consists of two or three strands (fig. 6 : G, H, and I). Likewise the forms whose lateral trace with two strands are seldom found (fig. 6 : I). In such types as in fig. 6 : G~I, two or three strands of the main or lateral traces unite into one during the transitional course from the node to the petiole.

In a usual condition the main trace attain without change to the petiole, but when a lateral trace like ℓ_1 is placed near it as in fig. 6 : C, E, F and H, the latter fuses with the former before entering the petiole. All the lateral traces except the last mentioned unite into one on both sides, below the level of transition where a few vascular branches derive from the united traces to enter the stipules (not shown).

Hydrangea involucrata Sieb. Twenty branches from ten individuals were examined. The genus *Hydrangea* is generally of trilacunar type except *H. involucrata* which shows various forms of tri-, tetra-, and pentalacunar types. These types are arranged randomly in one branch, and even two opposite sides of a node do not necessarily show the same type, for example, as 3 : 5-4 : 5-4 : 4-3 : 4-5 : 5-3 : 3 (each node is underlined).

Three forms are observed in the trilacunar type : 1) each lateral trace consists of one strand (fig. 7 : A), 2) each lateral trace consists of two strands (fig. 7 : B), and 3) one lateral trace consists of one strand and the other of two strands (fig. 7 : C). Two cases are observed in tetralacunar type : 1) each lateral trace with one strand only (fig. 7 : D) and 2) one lateral trace of one side consists of two strands and the two lateral traces on the other side consist of one strand (fig. 7 : E). The pentalacunar type shows an ordinary pattern of one strand per gap.

All the lateral traces of pentalacunar type enter into the base of petiole without

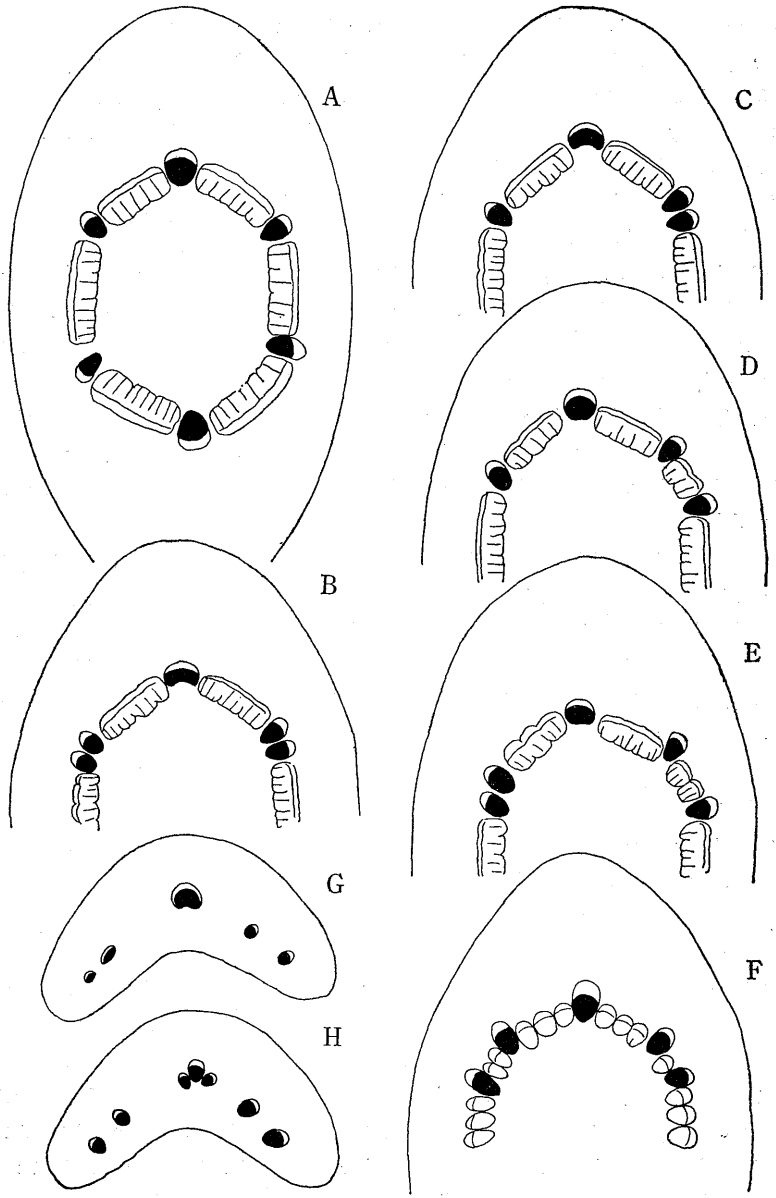

Fig. 7. *Hydrangea involucrata* Sieb.
A, B, C. Trilacunar type. D, E. Tetralacunar type. F. Pentalacunar type. G. Base of petiole H. Subbasal region of petiole.

division nor fusion resulting, with addtion of the median one, five strands (fig. 7: G). In the tri- or tetralacunar type, the lateral trace in each side with one strand the per gap always dichotomizes.

In the case when two lateral strands exist on one side, whether they appear in one set in a gap or one in one individual gap, they always enter unchanged into the base of the petiole.

In all the forms, the main trace enters into the petiole unchanged but afterwards it trichotomizes (fig. 7: G, H). Therefore in all the cases, seven strands can be seen at near the base of the petiole (fig. 7: H).

Rubus sieboldi Bl. Ten branches from five individuals were examined. This species shows 5-, 7-, and 9-lacunar types. They are arranged randomly on one branch, for example, as follows: 7-7-9-5-5-5; 5-5-7-7-5-7-9-5, etc. In all the types the main trace consists of three strands and enters the petiole unchanged.

In the pentalacunar type (fig. 8: A), usually each inner lateral trace, which consists of one strand, dichotomizes in the transitional area from the node to the

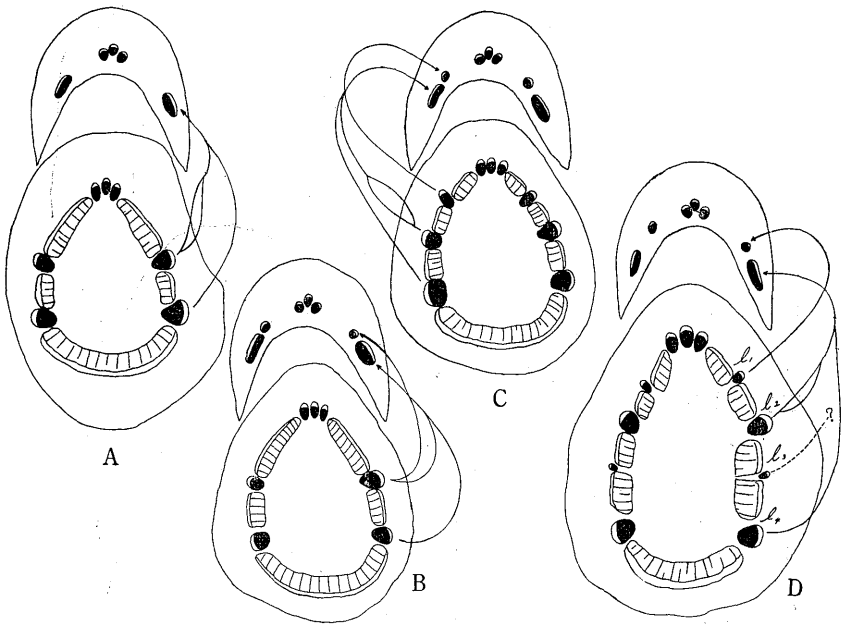

Fig. 8. *Rubus sieboldi* Bl. A, B. Pentalacunar type. C. Heptalacunar type. D. Nonalacunar type. ℓ_1, ℓ_2 ℓ_3 and ℓ_4 denote lateral traces.

petiole base, and the forked strands reunite and this again fuses with the outer lateral trace. Thus the fascicular system of the petiole base shows five bundles (three are in the central portion and one on both sides). But sometimes one outer branch of the dichotomized strands undergoes no fushion and unites with the outer

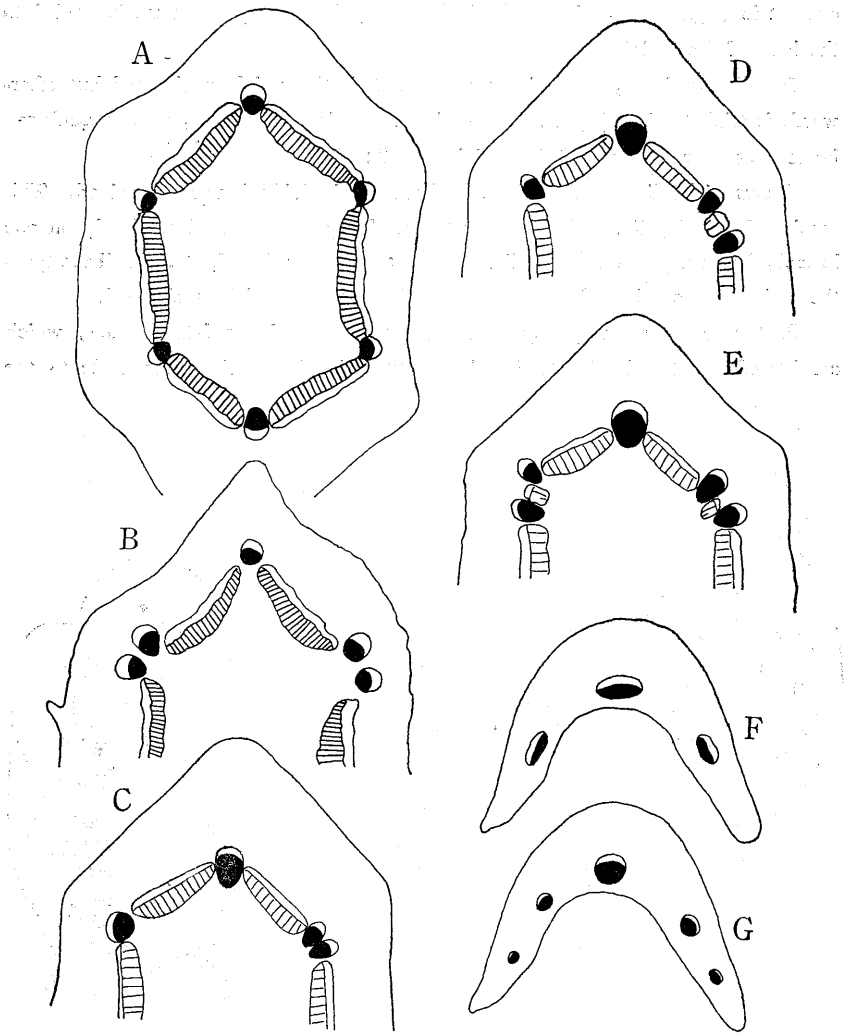

Fig. 9. *Weigela decora* Nakai. A, B, C. Trilacunar type. D. Tetralacunar type. E. Pentalacunar type. F, G. Base of petiole.

lateral trace (fig. 8: B). In this case there are seven bundles at the base of the petiole (three are in the central portion and two on both sides). In the 7-lacunar type (fig. 8: C), the middle lateral trace dichotomizes, and soon reunites into one and again fuses with the outer lateral trace. Thus seven bundles are seen at the base of the petiole. The 9-lacunar type is rare (fig. 8: D). The lateral trace ℓ_1 enters the petiole without division or fusion. The lateral trace ℓ_2 dichotomizes but soon reunites into one strand, then it fuses again with the lateral trace ℓ_4. As the rateral trace ℓ_3 is very small, its course from the node into the petiole is hardly traced. It seems to be suppressed and vanished during the course in the nodal region. So actually seven bundles are observed at the base of petiole.

Weigela decora Nakai. The genus *Weigela* is generally of trilacunar type. But in this species, various forms of tri-, tetra-, and pentalacunar types are observed in a single branch as in *H. involucrata*.

Three forms are observed in the trilacunar type: 1) each trace consists of one strand (fig. 9: A), 2) each lateral trace consists of two strands (fig. 9: B), and 3) one of the lateral traces consists of two strands and the other of one strand (fig. 9: C). Only one form is observed in tetra- and pentalacunar types (fig. 9: D, E).

Main trace of all the types always consists of one strand. Two strands of a lateral trace of the trilacunar type (fig. 9: B, C), two lateral traces on one side of the tetralacunar type (fig. 9: D), and two lateral traces on both sides of the pentalacunar type (fig. 9: E) all unite into one at the base of the petiole, or in some rare cases near the base up in the petiole. Therefore usually three bundles (fig. 9: F) and rarely five bundles (fig. 9: G) are seen at the base of the petiole.

Remarks Though the nodal type has been considered to be one of the taxonomically stable characters, it is, in my study, considerably variable. Therefore it must be brought to light for the necessary analyses. D. M. Post[2] treated this theme based on the species of *Frasera* and *Swertia perennis* of the Gentianaceae. These plants showed variation ranging from 1- to 7-lacunar types. He considered that this might be affected to some extent by the development of the secondary tissues which mask the primary tissues or partly by the enviromental factors.

Some interesting problems arise from my observations mentioned above. 1) The forms with small interlacunar region in *F. erecta* (fig. 5: C, E) are considered that one trace is divided into two and the resultant two strands become to possess their own gaps, or conversely that two traces are going to unite into one. 2)

The presence of the forms that the main trace consists of two strands in *F. nipponica* (fig. 6: G) or three in *F. nipponica* (fig. 6: H, I) and in *R. sieboldi* (fig. 8: A～D) is very noticeable. These two or three strands of the main trace of *F. nipponica* unite into one in the upper part of nodal region, but the three strands of the main trace of *R. siebeldi* enter the petiole without division or fusion. 3) The main trace usually does not fuse with any other trace, but when the main trace is placed near the innermost lateral trace as in fig. 6: C or F, the main trace fuses with them. 4) Although the similar nodal types are observed in *H. involucrata* and *W. decora*, the courses of traces from the node to the petiole are different between the two species as mentioned above. The author cannot interpret the reason why *H. involucrata* and *W. decora* show various types and forms compared with other congeners which have persistently trilacunar type with one trace per gap in general. Can it be considered that these are in transitional conditions within the genera of *Hydrangea* and *Weigela* in respect to the nodal types?

References

1) Kato, N. On the variation of nodal types in the woody plants (1) Jour. Jap. Bot. **41**: 101—107 (1966)

2) Post, D. M. Studies in Gentianaceae. I. Nodal anatomy of *Frasera* and *Swertia perennis* Bot. Gaz. **120**: 1—14 (1958)

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前報[1]に引き続き，節型の変異について報告する。数種の樹木の一年枝を，普通葉の各節ごとに横切して観察した結果である。

(1) イヌビワには三葉隙型，四葉隙型，五葉隙型があり，一本の枝に全部を見ることが出来る。さらに四葉隙型と五葉隙型には，葉隙間の距離の異なる種々の変異形が見られる。(2) イタビカズラには五葉隙型から九葉隙型まであり，一本の枝に種々の型を観察する事が出来る。通常葉跡は一本の維管束から成るが，主葉跡だけが二本又は三本の維管束から成っている変異形や，側葉跡が二本の維管束から成立している変異形も存在する。(3) タマアジサイは三葉隙型，四葉隙型，五葉隙型を示し，各々の型の中にいくつかの変異形が，同一の枝上又は同一の節の対生葉間でも見られる。(4) ホウロクイチゴでは五葉隙型，七葉隙型，九葉隙型を一本の枝で観察出来る。(5) ニシキウツギではタマアジサイと同じく，一本の枝に三葉隙型，四葉隙型，五葉隙型があり，各々の型にいくつかの変異形が見とめられる。(6) 以上の各種類の節に見られた種々の型及びその変異の有様は，種類ごとに節型が一定不変ではないことを示している。